The same form is in Herb. Ottawa under No. 24749 (fruiting branchlets) bearing the label "*Salix Scouleriana* Fl. Bor. Am. Dr. Richardson." Bebb, in 1891, made the note to it: "ticket evidently misplaced." If it is, however, a specimen of Richardson's (ex Herb. Mus. Brit.) the name only may be a lapsus calami. On the same sheet there is also a sterile branchlet which is not described by Richardson. In his description everything fits the specimen in Herb. N. Here we find on the same sheet a female specimen collected by Richardson on July 20, 1827 "N.Y. House." According to Franklin (Narr. second Exp. Polar Sea, 315 [1828]) Richardson on July 8, 1827, was at Fort Alexander, Manitoba, whence he went to Montreal. Where he was on the 20th of July is not stated, and I have been unable to find out where "N.Y. House" is. The specimen is identical with that from Fort Franklin.

There is, however, in Herb. Ottawa another specimen collected by Richardson and labeled "*S. rostrata* Richards. Franklin Expedition, between Forts Simpson and Chepewyan" (Chapewyan on Franklin's map). This specimen has narrow elliptic-lanceolate leaves which soon become almost glabrous beneath, and glabrous branchlets. Richardson's statements "folia sesquipollicaria, exstipulata, pube sericea caduca ? vestita subtus grisea sub-glauca" might refer to this glabrescent form. But if we take this specimen for the type, *S. rostrata* sensu stricto would be the same as our present var. *perrostrata*, and we should be obliged to take up the name var. *obovata* of Andersson for the eastern form which we at present regard as the type.

As I have not seen the material of the Hookerian Herbarium I use the name *Bebbiana* (*rostrata*) for the pubescent form which, however, is closely connected with var. *perrostrata* by numerous intermediate forms. Richardson's glabrescent specimen has rather thin, acute leaves which measure up to 4:1.2 cm. They are partly distinctly glaucescent beneath, the pubescence being very thin. The fruiting aments are old, the fruits measure about 8 mm., the pedicels about 4 mm. in length, and their pubescence is very thin.

Hooker, Barratt, Torrey and Carey used the name *S. rostrata* Richardson. When Andersson first dealt with the American Willows he named this species *S. vagans cinerascens occidentalis*. He cites Richardson, Gray and Hooker but he does not mention any specimens, and he also refers to it some Siberian forms. The quotation "*S. depressa cinerascens* Trautv." has been omitted in Sal. Bor. Am. 61. All the other forms of *S. vagans* given by Andersson in 1858 are of European origin. In 1867, he has a *S. vagans* 1. *S. rostrata* with the synonym *S. rostrata* Richardson and *S. vagans occidentalis* Andersson. This sub-species *rostrata* includes only American forms, and Andersson enumerates the following five varieties of it: *latifolia, lanata, obovata* (with forms *subambigua* and *subrepens*), *lanceolata* and *glabrescens*. To his second subspecies *cinerascens* Andersson, in 1867, does not refer American forms, but under his third subspecies, *S. livida*, we find a var. *americana* which is said to be connected by inter-

mediates with var. *glabrescens* of the subspecies *rostrata*. In 1868 Andersson reduced his subspecies to varieties, and we find under var. *β rostrata* only four forms: 1 *latifolia*, 2 *lanata*, 3 *obovata* (without any subform), and 4 *latifolia;* var. *glabrescens* of 1867 has been omitted.

Gray in 1867 used the name *S. livida occidentalis* for *S. rostrata*. Bebb, however, took up this name again in 1885 (in Coulter's Manual). Sargent, in 1895, changed the name *S. rostrata* to *S. Bebbiana* on account of the older *S. rostrata* Thuillier (Fl. Envir. Paris ed. 2, 517 [1797]). This new name has been accepted by several later authors. Robinson and Fernald (1909) keep Richardson's name, regarding *S. rostrata* Thuillier as a strict synonym. This name, however, is not an unconditional synonym (as for instance the name *S. longifolia* Lamarck, see Bot. Gaz. LXVII. 340). A. & E.-G. Camus (Class. Saul. d'Europe I. 163 [1904]) mention *S. rostrata* Thuillier in the synonymy of *S. repens* Linnaeus but again as a synonym of their var. A *vulgaris* subvar. *microphylla*. Von Seemen (in Ascherson & Graebener, Syn. Mitteleurop. Fl. IV. 127 [1909]) refers Thuillier's name as a synonym to his *S. repens* B. *rosmarinifolia* thus regarding it as identical with a form different from that of Camus. It is, therefore, possible that Thuillier's name may be used again as a specific name, and as the case stands it seems not advisable to apply the name *S. rostrata* to an American species.

With regard to the variability of *S. Bebbiana* it ought to be said that the floral characters as a whole seem to be very constant. The length of the style varies to a certain degree but we should need the investigation of a very large series of well-developed female specimens to decide whether the forms with a more conspicuous style (almost equaling the length of the stigmas) can be regarded as distinct. Fernald's var. *projecta*, a still very little known variety, seems to be the only one of which the flowers differ somewhat from those of the type, but here, too, the differences are not very important. On the other hand the variability of the leaves is much greater but it is extremely difficult to limit varieties. Andersson, apparently, did not see copious material, and he was inclined to lay too much stress upon certain variations which look very distinct as long as intermediate forms are not seen. As I have already mentioned Andersson first considered *S. Bebbiana* as var. *occidentalis* of his *S. vagans* 1. *cinerascens*. Later also he kept it as a variety of *S. vagans*.[1] I do not wish to-day to discuss the question whether the American *S. Bebbiana* is so closely related to any of the European-Asiatic forms which have been united under the name *livida*, *depressa* or *Starkeana* that it, too, must be regarded as a variety or a subspecies of it. I think it best to keep the American forms as a separate species.

As already explained, Andersson, in 1867 and 1868, established quite a number of forms of his subspecies or var. *rostrata*. It is strange that he also has besides *rostrata* which only consists of American forms another

[1] This *S. vagans* is the same as *S. livida* of Camus and *S. depressa* of Von Seemen. As I have tried to show the oldest name for this species is *S. Starkeana* Willdenow, see Sargent, Pl. Wils. III. 151 (1916).

American form under his subspecies or var. *livida* of which he, in 1867, says: "Ad formas denudatas *S. rostratae* attamen modificationes permultae adsunt transitoriae." This is his var. or f. *americana* of which the type was collected by Bourgeau "ad fluv. Saskatchawan." The var. *americana*, in 1868, is said to be characterized by "foliis magnis 2–3 poll. longis late lanceolatis v. subovali-obovatis grosse undulato-crenatis, primo tenuibus subtus partim glaucescentibus, demum rigidiusculis utrinque viridibus, nervis pallidioribus et prominenti-reticulatis pulchre percursis." He adds: "E regione ad fl. Saskatchawan plura specimina a Bourgeau lecta vidi." Among Bourgeau's specimens which I have seen none fitted this description. The statement that the leaves later become "utrinque viridibus" is rather strange. It is probable after all that var. *americana* does not belong to *S. Bebbiana*, and it is impossible to ascertain the identity of this variety without seeing the type.

"In *S. lividam americanam* aperte abiens" is Andersson's var. *glabrescens* of *rostrata*, the type of which, too, was found by Bourgeau on the Saskatchewan. From var. *americana* it "vix nisi foliis minutissime pubescentibus et forsan etiam majoribus differt." In 1868 this var. *glabrescens* is not mentioned by Andersson even as a synonym. One might be inclined to apply this name to what we now call var. *perrostrata* if there was not the statement that the leaves are rather larger than those of var. *americana*. Forms with such large leaves apparently do not belong to *S. Bebbiana* but to *S. discolor* or *S. balsamifera*. Only by a type specimen can the identity of the large-leaved form be established.

There remain to be discussed four more of Andersson's varieties of 1867. Of these var. *obovata*, according to the author is "forma typica. ubique in America septentrionali frequens." He distinguished two forms of it: f. *subambigua* and f. *subrepens*. The first is characterized by "foliis ovali-obovatis, rigidissimis, margine remote serrulatis, subtus lucide tomentellis." It was collected by Lyall "in Sumass-prairie." The second differs by "foliis lingulato-lanceolatis basi longe attenuatis, breve acuminatis, $1\frac{1}{2}$ poll. longis, supra medium vix $\frac{1}{2}$ poll. latis, subtus saepissime tomentosis." Bourgeau found it in the Rocky Mountains. In 1868, both forms are mentioned again but without names, and Andersson here states "Ambae in Rocky mountains (Bourgeau)." I have not yet seen a specimen of Lyall's from Sumass Prairie or of Bourgeau's from the Rocky Mountains which agree with these descriptions, and I must regard at present the two forms as uncertain, while I take var. *obovata* for a synonym of typical *Bebbiana*.

A narrow leafed form of the type seems to be Andersson's var. *lanceolata* of which in 1867 he says: "foliis elongatis supra medium parum dilatatis, fere 2 pollices longis vix $\frac{3}{4}$ poll. latis, utrinque pilis adpressis incano-hirtis; amentis magis densifloris." He himself adds "foliis tantum angustioribus a praecedente [var. *obovata*] recedunt." The diagnosis of 1868 is somewhat different, and it is impossible to decide the identity and the taxonomic value of this variety without the type.

Among Lyall's specimens from the "Lower Frazer River" in the Kew

Herbarium is one which Andersson himself named "*Salix vagans cinerascens latifolia*." In 1867 and 1868 he, however, states that the type of *S. vagans cinerascens rostrata latifolia* was collected by Lyall "in ins. Vancouver." The description runs: "foliis $2\frac{1}{2}$–3 poll. longis, supra medium 1–$1\frac{1}{2}$ poll. latis, longius acuminatis, tenuibus, subintegris, subtus molliter tomentosis; stipulis parvis acutissimis." I have not yet seen a specimen of *S. Bebbiana* from Vancouver Island, and Henry (Fl. South. Brit. Col. 98 [1915]) says of *S. Bebbiana:* "common east of the Cascades. Kamloops; Armstrong; Crows Nest Pass." It apparently does not grow on Vancouver Island. Therefore the type of Andersson's var. *latifolia* may belong to *S. Scouleriana.*

Of Lyall's specimens from the lower Frazer River before me none agrees with Andersson's var. or f. *lanata* which he, in 1867, characterizes as follows: "foliis ex ovato-subcordata basi ovali-oblongis, crassioribus, $1\frac{1}{2}$ poll. longis, integris, breve acuminatis, utrinque cinereo-sublanatis; capsulis magnis a basi latissima ovatis; ramis nudiusculis, junioribus fusco-tomentosis." In 1868 Andersson only says: "fol. ovato-subcordatis crassiusculis utrinque dense tomentosis." *S. Bebbiana* rarely has leaves with an ovate-subcordate base, and I have never seen young branches with a fuscous pubescence. On the other hand it seems hardly probable that Andersson misinterpreted this plant because he had seen the fruits. Otherwise one might believe that var. *lanata* should be referred to *S. Scouleriana* or some other species. After all Andersson's varieties and forms mostly are very uncertain. None of them can be regarded as really identical with one of the varieties discussed later.

As far as I can judge by the material I have seen there are two main variations: the typical *S. Bebbiana* (*S. rostrata* Richardson sensu stricto) which is found in the north and east, and a western-southwestern variety agreeing with Rydberg's *S. perrostrata*, and chiefly differing from the type by its smaller, smoother leaves glabrescent below. In his original description of S. *perrostrata* Rydberg does not state the differences between it and *S. Bebbiana.* In 1906 (and 1917) Rydberg says of *S. perrostrata:* mature leaves "thin, glabrous, faintly nerved," and of *S. Bebbiana:* "mature leaves firm, pubescent or tomentose beneath, more strongly nerved." These statements do not prove correct. The texture and nervation are often much alike in both varieties, and only by the glabrousness and by the general impression of the plant is it possible to decide whether it should be referred to the type or to var. *perrostrata.*

The type of *S. perrostrata* came from the Black Hills in South Dakota where it had been collected by Rydberg (No. 1018) near Hermosa in 1892. Rydberg also referred to it a specimen collected by R. S. Williams at Dawson, Yukon Territory. Coville (1901) said: "While his bibliographical references indicate that the species is a segregate of *bebbiana*, the author gives no comparison of distinguishing characters. I am unable to find in his description anything to distinguish our Alaskan specimens from what I take to be typical *bebbiana*, whatever may prove to be the relation of

that species to the Black Hills willow." I have seen a great number of specimens from the Yukon Territory collected by Miss Eastwood which partly can be regarded as var. *perrostrata*, and partly can hardly be distinguished from typical *S. Bebbiana*. Some are very glabrous. I have not yet seen the Alaskan material mentioned by Coville. What I call var. *perrostrata* seems to be the form prevailing from western Nebraska and western South Dakota through Colorado, northern New Mexico, eastern Arizona, Utah, northeastern Nevada and northeastern Oregon; this form apparently is becoming more similar to or is connected with the typical form by many intermediate forms in Idaho, Washington, British Columbia, Alberta, eastern Alaska (Cook Inlet, according to Coville), the Yukon Territory and the western parts of the Northwestern Territories. The typical *S. Bebbiana* seems to be predominant from Fort Franklin in the Northwest Territories to the James Bay and to Newfoundland, its range extending to the south to New Jersey, Pennsylvania, northern Ohio, northern Indiana, northern Illinois and Iowa. Very often it is almost impossible to decide in the herbarium whether a specimen belongs to var. *perrostrata* or to the type. Only a thorough study of copious material collected in those regions where both forms meet can prove whether var. *perrostrata* is a variety of real taxonomic value. Fernald (1914) sees in it the common Rocky Mountain representative of the species, and says that the leaves are less rugose or almost plane and glabrate in age, and the branchlets glabrate or quickly glabrescent. Its synonymy is as follows:

1b. **S. Bebbiana,** var. **perrostrata,** comb. nov. — *S. Bebbiana* Rydberg in Contrib. U. S. Nat. Herb. III. 523 (1896), pro parte maxima, non Sargent. — Coville in Proc. Wash. Acad. Sci. III. 306, fig. 17 (1901), pro parte maxima. — Ball apud Coulter & Nelson, New Man. Rocky Mts. Bot. 138 (1909) pro parte maxima. — *S. perrostrata* Rydberg in Bull. N.Y. Bot. Gard. II. 163 (1901); in Britton, Man. 317 (1901); Fl. Rocky Mts. 195 (1917). — Britton & Brown, Ill. Fl. ed. 2, I. 599 (1913). — *S. rostrata* var. *perrostrata* Fernald in *Rhodora*, XVI. 177 (1914). — A typo praecipue recedit foliis maturis etiam superioribus subtus fere vel omnino glabrescentibus laevioribus plerisque minoribus saepe tenuioribus, ramulis saepissime magis glabrescentibus.

In Colorado and New Mexico certain forms seem to occur of which the branchlets are somewhat pruinose. I enumerate the following specimens which need further observation.

COLORADO. Teller County: Colorado Springs, Pikes Peak, September 10, 1905, *Glatfelter* (st.: M.). El Paso County: Manitou, about 3300 m., September 9, 1905, same collector (fr. mat., st.; M.; fructibus adultis glabris sed normalibus [1]); Ute Pass, above Manitou Springs, along Fountain Creek, September 1, 1881, *G. Engelmann* (st., M.; forma incerta satis pubescens).

NEW MEXICO. Santa Fé County: Santa Fé Canyon, 9 miles east of Santa Fé, May 14, 1897, *A. A. & E. G. Heller.* (No. 3524, f.; M.); Santa Fé Creek above

[1] A form with entirely glabrous ovaries and pedicels has been collected by Macoun, Cabin Creek, Jasper Park, Alberta (No. 95792, O).

Santa Fé, September 18, 1916, *A. Rehder* (Nos. 604, 609, st.; A.; "shrub 10 feet"); same place, September 4, 1894, *C. S. Sargent* (st., A.; "tree 20 × 1 ft., pendulous branches, rough trunk, deeply furrowed dark brown bark").

With regard to the eastern forms proposed by Fernald of which I have seen the types the following may be said. The first variety is var. *luxurians* (in Rhodora, IX. 223 [1907]) which "is clearly an extreme variation of the common *S. rostrata*." It chiefly differs from it by its longer capsules (9 to 12 mm. long) and longer pedicels (5 to 8.5 mm. long). So far it has been only seen "on banks of the St. Lawrence from Rimouski Co. to Gaspé Co." in Quebec. It should be looked for in other localities of the type, and it apparently is nothing but a forma luxurians.

Fernald's next variety, var. *capreifolia* (in Rhodora, XVI. 177 [1914]) "presents the most extreme development of pubescence in the species . . . while var. *perrostrata* shows the opposite tendency." According to the material before me var. *capreifolia* is closely connected with the type by frequent intermediate forms. Fernald thinks that it "may prove to be the same as *S. vagans* 1. *rostrata* forma *latifolia* Andersson" of which I have already spoken. This is, however, in my opinion an uncertain form, and may even belong to another species. To var. *capreifolia* Fernald refers specimens from Newfoundland, eastern Quebec and Nova Scotia, and it apparently has a wider distribution.

Fernald states "in typical *S. rostrata* Richardson (*S. Bebbiana* Sargent) the new branchlets are pubescent at tip, but the pubescence is early deciduous." In the specimen of Richardson which I regard as the co-type (see p. 66) the branchlets of the season are distinctly pubescent, and only somewhat glabrescent toward the base, but even the branchlets of the preceding year are at least partly pubescent. Very rarely these branchlets are glabrous or almost so. The pubescence of the leaves, too, of typical *rostrata* is hardly very different from that of var. *capreifolia* of which the lower leaves also are partly glabrescent. A closer study of the western form may, however, lead to the hypothesis that there are glabrescent and pubescent forms of the type as well as of var. *perrostrata*.

The most striking of Fernald's forms is var. *projecta* (in Rhodora, XVI. 178 [1914]) which so far is very incompletely known. It has only been found in Newfoundland, Wild Cove, south of Bay of Islands, June 11, 1896, by A. C. Waghorne (fr.; G.). According to Fernald it differs from all varieties of *S. Bebbiana* "in the slender elongate ament, the long scales, the short capsules and pedicels shorter than the scales." Unfortunately there are neither mature leaves nor well-ripened capsules. The male plant, too, is unknown. Fernald says: "when better known this may prove to be a distinct species."

2. **S. Geyeriana** Andersson in Öfv. Svensk. Vet.-Akad. Förh. XV. 122 (1858), quoad specim. fem.; in Proc. Am. Acad. IV. 63 (Sal. Bor.-Am. 17) (1858); in Walpers, Ann. Bot. v. 750 (1858); in Svensk. Vet.-Akad. Handl. VI. 86 (Monog. Salic.) (1867), excl. t. 5, fig. 50; in De Candolle, Prodr. XVI.^{2} 226 (1868). — Rydberg in Mem. N.Y. Bot. Gard. I. 114 (Cat. Fl.

Mont.) (1900); Fl. Colo. 95 (1906); Fl. Rocky Mts. 195 (1917). — Howell, Fl. N.W. Am. 619 (1902). — Piper in Contrib. U.S. Nat. Herb. xi. 215 (Fl. Wash.) (1906). — Ball apud Coulter & Nelson, New Man. Rocky Mts. Bot. 138 (1909); apud Piper & Beattie, Fl. N.W. Coast, 117 (1915); in Bot. Gaz. lx. 399 (1915). — Henry, Fl. S. Brit. Col. 98 (1915). — *S. macrocarpa* Nuttall, N. Am. Sylva, i. 67 (1843), pro parte, non Trautvetter. — Bebb in Bot. Gaz. x. 221 (1885). — Macoun, Cat. Can. Pl. ii. 360 (1890). — Ball in Trans. Acad. Sci. St. Louis, ix. 80 (1899).

This Willow was first described as *S. macrocarpa* by Nuttall from specimens collected in Oregon. He does not quote a locality but only says "forming clumps in wet places." According to a co-type in the Gray Herbarium Nuttall had before him a form of var. *meleina*, but in his description he states that "the branches are smooth and brownish black, sometimes glaucous or whitish." Nuttall's name cannot be used because it is preoccupied by Trautvetter.

As Bebb already explained in 1885 Andersson entirely mistook Nuttall's species. He "transferred Nuttall's name to a single specimen collected by Burke 'ad Hudson Bay,' which Nuttall never saw, and described a new species of his own, *S. Geyeriana*, which . . . coincides absolutely with *S. macrocarpa*, Nutt." Andersson's *macrocarpa* is a species with "capsulis breve pedicellatis, conicis, glaberrimis, stylo mediocri, stigmatibus integris; foliis exstipulatis lanceolatis, integris, subtus pallidioribus, utrinque glaberrimis." It is entirely different from Nuttall's Willow which the author regarded as closely related to the Pond Willow (*S. sericea*). Andersson (1858) apparently had no knowledge of Nuttall's description, but he had an opportunity to examine those of Nuttall's specimens which are preserved in the Hookerian Herbarium. When he described his *S. Geyeriana* he based it on Geyer's No. 286 of which the exact locality is unknown. Andersson says "Missouri and Oregon, Rocky mountains." I have seen a photograph of this number and fragments of the female specimen, and also a male ament. The female plant only is *S. Geyeriana*, while the male ament belongs to *S. Bebbiana*. This has already been elucidated by Bebb, and he is right in the statement that Andersson's description is almost wholly drawn from the female plant. The male specimen is only mentioned in the following sentence (1858): "Amenta mascula etiam breviora et crassiora stamina magis aureo-fulvis quam in *S. vaganti* [S. Bebbiana]." In 1868, too, Andersson says: "*S. vaganti-rostratae* valde similis" but to Bebb this comparison seems "unintelligible" because "the affinity of the plant in question — as Nuttall had the sagacity to see — is really with *S. sericea*." I do not quite agree with Bebb because the shape of the capsules is very different in both species. Of *S. sericea* the mature fruits are short and blunt scarcely longer than 5 mm. with a pedicel 1.5 (–1.7) mm. long, while in *S. Geyeriana* the ovoid-rostrate capsules measure almost (5–)6–7 mm. in length excluding the 2–3 mm. long pedicel. Their shape is much more like that of the fruits of *S. Bebbiana*.

According to the female plant of Geyer's No. 286 the typical *S. Geyer-*

iana is the form with pruinose branchlets of which those of the year bear a fine silky tomentum. The statement of Andersson that the pedicel is six times longer than the gland is not correct as it is only 2 to $2\frac{1}{2}$ times longer. The stigmas are not sessile but they show a short style which often is bifid at the top, but hardly longer than the two-cleft stigmas. The statement "foliis molliter tomentosis" seems to indicate that Andersson probably had before him other specimens of *S. Bebbiana* than the male of which I have seen a photograph. In 1867 he speaks of the male aments as "sessilia, ebracteata" while in 1868 he says "vix bracteata." The type of *S. Geyeriana* before me clearly shows a short but distinct peduncle with a few small leaflets at least under the upper aments. The leaf represented in fig. 50 on plate 5 of Andersson's monograph certainly belongs to *S. Bebbiana*, the drawing of the female flower, too, agrees much better with this species. The statement of Geyer that the plant is "10–15 feet high" also refers to *S. Bebbiana* a species which as a whole is so easily distinguishable from *S. Geyeriana*.

There are two forms which can be separated from the type. One has been described by Bebb as var. *argentea* (of *S. macrocarpa*) for the type of which has to be taken a specimen of Lemmon's from Sierra County, California, of which I have seen co-types in Herb. G. and M. In Bebb's Herbarium is a male specimen collected by Lemmon at Sierra Valley without date and number but I have found no real type. This var. *argentea* is probably nothing but a very silky form of the type and its synonymy is as follows:

2b. **S. Geyeriana** var. **argentea,** comb. nov. — *S. Geyeriana* Bebb apud Watson, Bot. Cal. II. 87 (1879), non Andersson. — Rydberg, Fl. Colo. 95 (1906), ex parte. — *S. macrocarpa*, var. *argentea* Bebb in Bot. Gaz. x. 223 (1885); apud Coville in Contrib. U.S. Nat. Herb. IV. 199 (1893). — Ball in Trans. Acad. Sci. St. Louis, IX. 80 (1899). — *S. leucosericea* Bebb & Nelson apud Nelson in Bull. Wyom. Exp. Stat. No. 28, 179 (First Rep. Fl. Wyom.) (1896), nom. nud.[1] — A typo praecipue recedit pubescentia ramulorum foliorumque novellorum densiore et omnino argentea vel tantum pilis paucissimis ferrugineis intermixta.

Of this variety I have seen specimens from the following states and counties: southern Idaho (Owyhee, Bear Lake and Blaine Counties), eastern Oregon (Union, Crook and Harney Counties), Wyoming (Fremont, Sweetwater, Albany, Sheridan and Bighorn Counties), Colorado (Laramie, Lake and San Migual Counties), Nevada (Elko County), California (Plumas, Sierra, Nevada, Placer, Eldorado, Mono, Tuolumne, Tulare, and Fresno Counties).

Another form of apparently greater taxonomic value is var. *meleina* described by Henry (Fl. S. Brit. Col. 98 [1915]) as follows: "var. *meleina:*

[1] Nelson, l. c., says: "In communicating this name to me Mr. Bebb made the following comment: 'It will shortly appear as above in a government report. This is the Rocky Mountain or Plateau member group which has for its eastern or Atlantic Coast representatives, *S. sericea* and *S. petiolaris*, and for the Pacific Coast *S. macrocarpa*.'"

Taller, 1-7 m. high; twigs black or green and black, without bluish bloom, the older branches often banded with gray and black; leaves oblong, soon glabrous above, very glaucous beneath, the hairs on the lower surface becoming more or less brown. The coast form; Shawnigan; Victoria; New Westminster." As I already stated it is partly the typical *S. macrocarpa* of Nuttall. The leaves sometimes are somewhat denticulate, the lower surface often becomes almost glabrous and their texture is firmer than of those of the type. The branchlets of the year are not unfrequently rather orange-colored (see for example Suskdorf's specimens from Falcon Valley, September 7, 1896). Of var. *meleina* I have seen specimens from British Columbia (Vancouver Island and New Westminster District), Washington (Stevens, King, Mason, Thurston, Pierce, West Klickitat and probably Clarke Counties where Nuttall seems to have collected the type of *S. macrocarpa* on the banks of the Columbia), Montana (Flathead and Missoula Counties) and northwestern Oregon (Columbia and Marion Counties).

The typical *S. Geyeriana* is known to me from the following states and counties: northwestern Idaho (Shoshone and Latah Counties), Montana (Deer Lodge, Gallatin and Madison Counties), Oregon (Grant, Jackson, Crook, Wallowa, and Klamath Counties), Wyoming (Yellowstone Park, Albany and Sheridan Counties), eastern Nebraska (Scotts Bluff County), Colorado (Jackson, Larimer Lake, Gunnison, Mineral, and Grant Counties) and Utah (Sevier County; a specimen of H.D. Langille, from Uinta Mountains, 1902, [No. 125, m., f.; A.; "5–7 feet high"] is uncertain, the leaves show stomata in their upper epidermis), Arizona (Coconino and Apache Counties).

3. **S. Lemmonii** Bebb apud Watson, Bot. Cal. II. 88 (1879); in Bot. Gaz. XVI. 106 (1891) — Jepson, Fl. Cal. 343 (1909), pro parte. — Rydberg. Fl. Rocky Mts. 196 (1917), pro parte. — When Bebb described this species he proposed three varieties basing his descriptions mainly on specimens collected by J. G. Lemmon in Sierra County, California. The first is var. *melanolepis* characterized by pitch-black and slightly or not at all hairy scales. Bebb cites no type but there is one in his herbarium in the Field Museum (No. 7794) consisting of male and female specimens. Here, too, are type specimens of the second var. *macrostachya*, and the third var. *sphaerostachya*, and two sheets which represent the typical form. All these specimens came from Sierra Valley in Sierra County, except those of var. *sphaerostachya* which are only marked "Sierra Nevada."

The type of *S. Lemmonii* (No. 7800 in Herb. Bebb) has unripe fruits and young leaves, and well agrees with that of var. *melanolepis*. The differences mentioned above are of no importance, because we can observe a change in the pubescence of the bracts not only in the aments of the same twig but even in the bracts of the same ament. Only in the male syntype of var. *melanolepis* (sheet 7799 in C.) the glabrousness of the bracts is a little more conspicuous. The size of the aments and the more or less ful-

vous pubescence of the young leaves are the same in both types. The young twigs are thin, slender, mostly covered with a grayish and rusty pubescence but soon becoming glabrous.

Bebb's var. *macrostachya* has female aments which measure up to 6.5 cm. in length but their peduncles are hardly different (Bebb says "more leafy"). The style is 1 mm. long; the fruits are not yet quite mature and scarcely more "tapering to a produced style" than those of the other forms. The male aments are hardly a little larger (to 3.5 : 1.3 cm.), and scarcely more silky than those of the type. In his main description Bebb says: "scales . . . black, thinly pilose." The pedicels always are only 2 to 3 times and not "4–6" times longer than the nectary. The var. *sphaerostachya* certainly is nothing but "a depauperate or subalpine form" as Bebb himself indicated. The type in Bebb's herbarium bears the No. 6752, and it is identical with a cotype in the Gray herbarium. The reddish brown or orange-colored branchlets show faint traces of a glaucous bloom thus pointing to var. *Austinae* (see later).

Bebb likened his species to *S. macrocarpa* (= *S. Geyeriana*) which "differs especially in its smaller pale acute scales, glabrate capsules, and nearly sessile stigmas." *S. Geyeriana meleina* has a rather distinct style (up to 0.5 mm. long), and there seems to be no difference as to the pubescence of the capsules. In this form of *S. Geyeriana* the glaucous bloom of the twigs is also wanting.

The leaves of *S. Lemmonii* are not only "paler or scarcely glaucous beneath" (Bebb) but the mature ones are distinctly glaucescent and by no means "green, nearly alike on both sides," as Jepson says. See Lemmon's specimen with mature leaves which Bebb makes the type in his herbarium (No. 6753 Bebb). *S. Lemmonii* apparently has been misunderstood by recent authors, and the diagnosis of Bebb is rather insufficient. Therefore I think it best to give the following more complete description and an enumeration of the specimens which I have seen. Frutex erectus ut videtur divaricato-ramosus, 1–3, raro ad 5 m. altus. Ramuli novelli tenuiter sericeo-pilosiusculi (pilis argenteis ferrugineisque mixtis), hornotini glabri vel fere glabri, interdum parce pruinosi (confer specimina a cl. Ware in Mono Pass lecta), annotini biennesque brunnescentes, purpurascentes (vel interdum fere atropurpurei), glabri, nitiduli (in *S. Geyeriana* opaci), demum cinereo-nigrescentes; gemmae ut videtur ovoideo-oblongae vel ovoideae, obtusiusculae, ut ramuli coloratae, demum glabrae, divaricatae, floriferae quam foliiferae crassiores. Folia membranacea, sed adulta satis firma, anguste lanceolata, oblanceolata, anguste elliptico-lanceolata, basi acuta vel subobtusa, apice acuta ad subacuminata, interdum subapiculata, infima pleraque obtusiora, margine integra vel (saltem ad medium) parce distanter brevi-denticulata, infima saepe oblongo-spathulata interdum densius obscure glanduloso-denticulata, 1 : 0.3 ad 2.5 : 0.6 cm., superiora perfecte evoluta 3 : 0.8 ad 5.5 : 1 vel 7–9 : 1–1.5–1.8 cm. magna; superne novella plus minusve adpresse sericea vel sericeo-villosula, pilis griseis et ferrugineis mixtis, deinde saepissime cito glabrescentia et adulta glabra

vel pilis paucis difficile recognoscendis praedita, ut videtur vivide et intense viridia, in epidermide stomatibus plus minusve numerosis instructa, laevia vel costa nervisque laevissime prominulis; subtus initio ut superne pilosa, demum etiam, saepe citius, glabrescentia et adulta distincte glaucescentia, pleraque tenuissime adpresse breviter sericea glabrave, costa flavescente elevata, nervis lateralibus utrinque 6–10 (–12) vix prominulis; petioli tenues, pilosuli (saltem superne in sulco), 2–7 mm. vel interdum fere ad 16 mm. longi; stipulae minimae vel parvae, lanceolatae vel semiovato-lanceolatae, plusminusve acutae, glanduloso-denticulatae (partim lobulato-dentatae), ut folia pilosae, petiolis pleraeque 2–3-plo breviores, deciduae vel nullae, raro in surculis ad 8 mm. longae. Amenta coetanea, pedunculo brevi bracteato vel distincte foliolato suffulta, rhachi villosula; mascula densiflora, ellipsoideo-cylindrica vel cylindrica, 1:0.7 ad 3:1.2 (rare ad 3.5:1.4) cm. magna pedunculo brevissimo vel vix ultra 5 mm. longo foliolis lanceolatis acutis plus minusve integris superne fere glabris subtus adpresse et satis longe sericeis (pilis ferrugineis argenteisque mixtis) vix ultra 12:4 mm. magnis praedito excluso; bracteae obovatae vel obovato-oblongae, apice rotundatae vel obtusiusculae, laxe longe sericeae, pilis summis quam bractea saepissime subbrevioribus, rarius apice plusminusve glabrescentes; stamina 2, filamentis liberis (interdum paullo vel ad $\frac{1}{3}$ coalitis), fere ad medium pilosis bracteam demum 2–3-plo superantibus, antheris aureis parvis crasse ellipsoideis; glandula 1, ovoideo-rectangularis, truncata, bractea duplo vel subduplo brevior; amenta feminea sub anthesi 1–2.5: 0.8–1 cm. magna, pedunculo ut in masculis vel ad 6–12 mm. longo et distinctius foliolato (foliolis saepe deciduis), fructifera 2:1.5 ad 3.5–4:1.8 (rarius ad 6:2) cm. magna; bracteae ut in masculis vel interdum apice acutiusculae, initio pedicellum paullo vel interdum fere subduplo superantes, demum eum aequantes vel rarius eo $\frac{1}{4}$ breviores; ovaria anguste ellipsoideo-conica, breviter sericeo-tomentosa vel laxius plusminusve adpresse sericeo-villosula; styli breves, saepissime 0.5–1 mm. longi, integri vel apice breviter bifidi; stigmata breviter oblonga, bifida, stylo circiter duplo, rarius paullo tantum breviora; pedicelli distincti, tenues, 1.5–2 vel in fructibus interdum ad 2.5 mm. longi, ut ovaria pilosi vel (in typo) partim vel fere omnino glabri; glandula 1, ventralis, ut in masculis vel paullo angustior, in ovariis pedicello 2–$2\frac{1}{2}$-plo, in fructibus interdum ad 3-plo (sed non 4–6-plo ut ab auctore indicatum) brevior. Fructus perfecte maturi ellipsoideo- vel ovoideo-rostrati, pedicello excluso 6–8 mm. longi, ut ovaria vel paullo laxius pilosi.

Specimens examined: California. Lassen County: Hot Springs Valley, near Lassen Peak, circ. 2000 m., June 6, 1910, *W. L. Jepson* (No. 4081, fr.; Jeps.; a small-leaved form resembling var. *meleina*). Plumas County: without exact locality, May 1877, *R. M. Austin* (f.; G.; the male specimen is *S. lasiolepis*); June 1878, same coll. (m., f.; G.); May 1879, same coll. (f.; G.; forma incerta ovariis partim pedicellis totis glabris, foliis superne parce stomatiferis); Warner Valley, about 1700 m., June 5, 1910, *W. L. Jepson* (No. 4066, st.; Jeps.; forma porro observanda foliis parvis superne sparse stomatiferis); Portola, May 25, 1918, *A. Eastwood* (No. 7004, f., 7005, m.; A.). Sierra County: Sierra Valley, without date, *J. G. Lem-*

mon (st., old fruits; sheet 6753 in C.), same coll. (f., type of var. *melanolepis*, sheet 7794 in C.; m., sheet 7799); same coll. (fr. juv., type of *S. Lemmonii*, sheet 7800 in C.); same coll. (f.; type of var. *macrostachya*, sheet 6754 in C.; m.; sheet 7795); same coll. (f., fr.; sheets 7798, 7796 in C.); Sierra Nevada, same coll. (f. m.; type of var. *sphaerostachya;* sheet 6752 in C.); west side of Webber Lake, near shore, June 21, 1900, *W. R. Dudley* (No. 5415, m.; St.); shore of Webber Lake, the common Willow, August 29, 1894, *Dudley* (st.; St.). Nevada County: Ice Lake near Soda Springs, on Pacif. Railr., about 2800 m., October 11, 1880, *G. Engelmann* (st.; M.); Truckee, May 1892, *C. F. Sonne* (No. 40, f.; C.); flat land on Yuba River, opposite Cascade, June 15, 1900, *W. R. Dudley* (No. 5151, a. m.; St.); valley near Lake Mary, near Summit, same date and coll. (Nos. 5104, m., 5111, f., 5115, m., 5115[a], f., 5116, f., 5116[a], m., 5117, f., 5120, m., 5122, f., 5128, fr.; St.); along South Yuba River, same date and coll. (Nos. 5139, fr., 5139[a], m.; St.); near hotel at Summit, same date and coll. (Nos. 5103, m., 5130, fr.; St.); grade east of hotel at Summit, same date and coll. (Nos. 5092, 5098, f.; St.); road between Summit and Cisco, same date and coll. (Nos. 5141, f., 5142, fr., 5143, fr., 5144, m., fr., 5145, f., 5146, m.; St.); Donner Lake, 500 yards below upper dam, June 14, 1900, same coll. (No. 5019, fr.; St.); Webber Lake and Serraville Trail, June 21, 1900, same coll. (No. 5475, f.; St.) Glenbrook near Truckee, June 28, 1900, same coll. (Nos. 5775 m., 5777, 5778, 5780, fr.; St.); Tahoe City, on meadow, most common willow, June 29, 1900, same coll. (Nos. 5796, 5799, 5800, fr.; St.); Independence Lake, meadow east of outlet and below bridge, June 19, 1900, same coll. (No. 5278, m.; St.). Placer County: Summit, about 2700 m., July 16, 1909, *A. A. Heller* (No. 9842, f.; G; sub nomine *curtiflora* distributa); low grassy places along Yuba River below Cisco, about 1800 m., June 17, 1917, same coll. (Nos. 12688, 12721, f.; St., C.); Lake Tahoe Region, Deer Park, June 15–19, 1912, *A. Eastwood* (Nos. 364, m., 432, f.; A.); road above Donner Lake, June 14, 1900, *W. R. Dudley* (No. 5081[a], f.; St.); between Donner Lake and Summit on "loop grade," same date and coll. (Nos. 5065, 5065[a], fr., 5066, 5067, f., 5069, m., 5070[a], f., 5077, 5078, fr.; St.); by Lake shore near Maddenie Cr. above McKinney's Cr., June 1900, same coll. (No. 5533, st.; St.). Eldorado County: Tallac (?) House to Desolation Valley, June 1900, same coll. (fr.; St.); near Tallac (?) House, June 28, 1900, same coll. (No. 5666, fr.; St.); near Camp Agassiz, June 17, 1900, same coll. (No. 5665, fr.; St.); Glenn Alpine, June 1900, same coll. (No. 5661, fr.; St.). Alpine County: near Highland Lake, about 2700 m., July 24, 1911, *L. R. Abrams* (Nos. 4748, f., m.; 4751, f.; G., St.); Icebery (?) Meadow, Clock's fork, about 2200 m., July 22, 1911, same coll. (No. 4745, fr.; St.). Amador County: Silver Lake, about 2700 m., July 1892, *G. Hansen* (No. 199, fr.; M., St.). Mariposa County: Yosemite Valley, May and June 1900, *F. T. Bioletti* (f., m.; A.); vicinity of Lake Tenaya, about 2700 m., June 1902, *Hall & Babcock* (No. 3524, m., fr.; Jeps., St.); Lake Merced, about 2400 m., July 9, 1909, *W. L. Jepson* (No. 3194, fr.; Jeps.); Glacier Point, Turn Pike, May 26, 1888, *J. W. Congdon* (No. 123, f.; St.). Mono County: Mono Pass, Bloody Canyon, about 2800 m., July 23, 1907, *R. A. Ware* (fr.; G.; folia maxima ad 6.5:1.1 cm. magna, ramuli partim parce pruinosi). Tuolumne County: Tuolumne River Meadow, 2 mi. below Soda Springs, about 2750 m., July 18, 1909, *W. L. Jepson* (No. 3357, st.; Jeps.); Kennedy's Lake, about 2700 m., August 12, 1915, *A. L. Grant* (No. 246, fr.; A.). Fresno County: Horse Corral Meadow, region of King's River, August 11, 1900, *W. R. Dudley* (Nos. 3174, fr., 3177, st.; St.); King's River Canyon, same date and coll. (No. 3214, fr.; St.); Upper King's River, Rowell Meadow woods, June 21, 1900, same coll. (fr.; St.). Tulare County: Sequoia National Park, Marble Fork, about 2500 m., July 15, 1902, *G. B. Grant* (No. 1514, fr.; St.); [Milky Meadow to Three Rivers], Whitney (now Volcano) Creek, about 2800 m., July 23–31, 1900, *W. L. Jepson* (No. 954, st.; Jeps.); region of Sequoia National Forest, Vicinity of Homer's Nose, Cahoon Meadow, about 3000 m., July 13, 1897, *W. R. Dudley* (No. 1846, fr.; St.); region of Little Kern River, Barut (?) Corral Meadow, August 10, 1897, same coll. (No.

1979, fr.; St.); Vicinity of Mount Whitney, August 8, 1897, same coll. (No. 2501, st.; St.)

NEVADA. Ormsby County: Snow Valley, 2460–2615 m., June 24, 1902, *C. F. Baker* (No. 1162, f., m.; A., Cal., G., N.). Washoe County: Divide, south of Slide Mountain, in granite, about 2500 m., *A. A. Heller* (No. 10928, fr.; A., C., G., M.); ridge above Bowers, about 2200 m., same date and coll. (No. 10937, fr.; St.); about Marlette Lake, 2460 m., July 10, 1902, *C. F. Baker* (No. 1294, fr.; Cal.).

According to Jepson *S. Lemmonii* is also known from the Wasatch Mountains in Utah, but I have not seen any material from that region. Rydberg states that the species occurs as far east as Idaho. What I have seen from Idaho bearing the name *S. Lemmonii* did not at all belong to this species. This is the case, too, with Cusick's No. 1835 from eastern Oregon which (at least partly) seems to consist of male and female specimens of different species. His No. 1836 mostly represents the following variety.

S. Lemmonii, var. **Austinae,** var. nov. — *S. Austinae* Bebb apud Watson, Bot. Cal. II. 88 (1879); in Bot. Gaz. XVI. 106 (1891). — Bebb described *S. Austinae* from specimens collected by Mrs. R. M. Austin at Indian Valley, Plumas County, California. In Bebb's herbarium I have found only one specimen by this collector under *S. Austinae* (sheet 3388). Bebb did not put a name on it but he made sketches of the male and female flowers on the sheet. It is identical with other sheets in Herb. C. (Herb. Patterson) and in Herb. C. U. In 1891 Bebb stated that "the leaves described belong to S. *Lemmonii*, and in some (though not all) of the specimens male aments of *S. lasiolepis* were intermixed." But "there yet remain the fertile aments not identificable with any willow of the Pacific Coast region as at present understood." If we take sheet 3388 in C. which well fits Bebb's description for the type it can be said that the leaves are not distinguishable from those of *S. Lemmonii*. The male and female aments, however, may well belong to one species, and the male aments are not identical with those of *S. lasiolepis*. Bebb does not describe the male flowers, but his sketch on the sheet shows glabrous filaments. A close investigation of the flowers revealed to me the fact that the filaments are hairy for about a fifth of their length and are often slightly connected at the base. The flowering branchlets are glabrous, orange-colored, and slightly shining. Those of the male specimen are hardly pruinose while the glaucous bloom is rather conspicuous on the branchlets of the female specimen which are of the same color. This glaucous bloom seems to be the main character to distinguish var. *Austinae* from *S. Lemmonii*. It is also to be seen on the specimens collected by Cusick in eastern Oregon (No. 1306 and 1836) which are named *S. Lemmonii*, and on a piece without number in Bebb's herbarium (sheet 7760 in C.). Pruinose twigs I also observed in Grant's No. 290 from Tuolumne County, the leaves of this specimen having stomata in their upper epidermis. After all I suppose that *S. Austinae* can best be considered a variety of *S. Lemmonii* but certainly a thorough study of more copious material is needed than I have been able to investigate. From the specimens enumerated below I have drawn the following diagnosis. Frutex vel arbor parva;

ramuli initio laxe tenuiter pilosuli pilis griseis et paucis fulvis mixtis, hornotini autumno glabri, flavo-brunnei vel ut annotini floriferi magis rubescentes vel purpurascentes, nitiduli, saepe leviter pruinosi; gemmae (in No. 1836 Cusickii) ovoideo-oblongae, acutae, petiolis plusminusve aequilongae. Folia textura coloreque ut in *S. Lemmonii*, initio fusco-pilosi pilis griseis intermixtis (in costa etc.), pubescentia, deinde quamvis ut in *S. Scouleriana*, anguste lanceolata vel lanceolata, basi acuta vel saepissime satis obtusa, apice acuta vel breviter acuminata (minimis lineari-oblanceolatis obtusioribus exclusis), 3.5:0.8 ad 6.5:1.1 vel ad 9:2 vel 8:2.1 cm. magna, margine obscure subserrata vel satis distanter serrata, superne subtusque ut in *Lemmonii*, subtus distincte albescentia vel glaucescentia, pruinosa, costa elevata flava nervisque lateralibus flavis graciliter prominulis et satis indistincte reticulata; petioli stipulaeque ut in *Lemmonii*. Amenta praecocia vel subcoetanea, cylindrica, densiflora, pedicello brevi foliola minima 2–3 lineari-lanceolata superne glabra subtus sericea decidua gerente 1–5 mm. longo suffulta; mascula vix ultra 2.8 : 1. 2 cm. magna; bracteae atrofuscae, obovato-oblongae, utrinque sericeae, obtusae; stamina 2, filamentis basi parce pilosis, interdum paullo coalitis, bracteam duplo superantibus, antheris ellipsoideis flavis; glandula 1, oblongo-rectangularis, truncata, bractea subtriplo brevior; amenta feminea sub anthesi 2–2.8:1 cm. magna; bracteae ut in floribus masculis; flores ut in *Lemmonii;* styli vix ultra 0.5 mm. longi; pedicelli vix ultra duplo longiores quam glandula; stigmata stylo subaequilonga, breviter oblonga, divaricata; glandula ut in masculis. Fructus maturi mihi tantum ignoti.

SPECIMENS EXAMINED: CALIFORNIA. Plumas County: Indian Valley, without date, *Mrs. Austin* (m., f., st.; type in C., sheet No. 3388; the same is sheet 361195 in C. U., 204066 Herb. Patterson in C. and sheet 346815 Herb. Schuette in C.; on sheet 204065 Herb. Patterson in C. is a label of Bebb's with the note: "I suppose we call this all *S. Austinae* — but I begin to fear that the dividing line between *Austinae* and *Lemmonii* is hazy to say the least"). Sierra County: Sierra Valley, without date, *Lemmon* (m., f.; sheet 7792 Herb. Bebb in C.; apparently nothing but typical *Lemmonii;* the same is sheet 7793).

OREGON. Union County: without date, *Cusick* (m., f.; sheet 7760 in C.; named by Bebb "*S. Lemmonii*, mixed with flowers of *S. flavescens*." The male branchlets are distinctly pruinose; the sterile specimen has lanceolate obovate acute leaves with a more or less conspicuous crenate dentation, a glabrous under surface, and distinct stipules). County ?: Mountains of Eastern Oregon; banks of streams, about 1350 m., *Cusick* (No. 1306, fr., st.; sheet 7759 in C.; leaves and branchlets as in the foregoing specimen); a slender shrub of streambanks, April 19, May 9, September, 1898, same coll. (No. 1836, f.; sheet 109712 in C.; named *S. Lemmonii* but looking much like *S. Geyeriana*, leaves without stomata in their upper surface); apparently same region, same date and coll. (No. 1835, f., m. st.; sheet 109711 in C.; the large leaves partly become greenish beneath, the bloom of the twigs is hardly recognizable; in different herbaria are somewhat different specimens under this number.)

Bebb (1891) said, that Cusick found the species in eastern Oregon but unfortunately he did not quote Cusick's numbers. In Bebb's herbarium I have found the three sheets of Cusick's just mentioned. To the sheet 7759 are added two letters of Cusick's, in one of them (dated October 10, 1887) he states that his numbers 1510 and 1610 represent *S. Lemmonii*. I did

not, however, detect specimens bearing these numbers in Bebb's herbarium. Cusick also says in the letter the following as to the differences between *macrocarpa* (*Geyeriana*) and *Lemmonii:* "*S. Lemmonii* is a much larger shrub, sometimes a tree 8 or 10 inches in diameter; seldom or never upright, divaricately branching; growing in widely spreading clumps and commonly on the bank of rocky swift running streamlets. The *macrocarpa* form is smaller, slender and virgate; the tops gradually dissolving into small branchlets, one plant one inch in diameter is large and will be 6 to 8 feet high; it is found more commonly along sluggish or marshy streams. I saw it in great abundance on Stein's Mountains in Malheur Co. in the summer of '86." Possibly Cusick's *Lemmonii* is identical with var. *Austinae.* Another sheet of Cusick's (No. 7758) I take for *S. Scouleriana.* It consists of a sterile specimen with old leaves measuring up to 9–11 : 4–3 cm. and bearing beneath the typical short brownish pubescence of *Scouleriana.*

b. THE SPECIES OF SECTION ROSEAE

This section was proposed by Andersson in 1867 for the species *S. prolixa* Andersson, *S. myrtilloides* Linnaeus and *S. fuscescens* Andersson to which he added a number of European hybrids. The type species is *S. myrtilloides* because he named the section "Stirps X. Salices roseae v. S. myrtilloidis," and later, in 1868, "§ 10. Roseae s. Myrtilloides." Andersson's first species *S. prolixa* is a very little known Willow. The true *S. myrtilloides* is not found in the New World where it is represented by *S. pedicellaris* Pursh treated by Andersson as a subspecies or as a variety of *S. myrtilloides. S. fuscescens,* too, needs further study, and this section as a whole is a group of rather doubtful taxonomic value. The best I can do at present is to discuss briefly these American species, and to advise other students who have a good opportunity to collect better material and to study the plants in the field. The synonymy of the group is as follows:

Sect. *Roseae* (sive *Myrtilloides*) Andersson in Svensk. Vet.-Akad. Handl. VI. 94 (Monog. Salic.) (1867); in De Candolle, Prodr. XVI.^{2} 229 (1868). — Sect. *Arbusculae* Barratt apud Hooker, Fl. Bor.-Am. II. 150 (1839), pro parte, quoad *S. pedicellaris.* — Sect. *Virentes* Andersson in Öfv. Svensk. Vet.-Akad. Förh. XV. 123 (1858), pro parte quoad *S. myrtilloides.* — Sect. *Myrtilloides* Zabel apud Beissner, Schelle & Zabel, Handb. Laubholz-Ben. 30 (1903). — Sect. *Argenteae,* subsect. *Myrtilloides* Schneider, Ill. Handb. Laubh. I. 63 (1904).

1. **S. pedicellaris** Pursh, Fl. Am. Sept. II. 611 (1814). — Poiret in Lamarck, Encycl. Suppl. VI. 62 (1817). — Torrey, Fl. N.Y. II. 213, t. 120 (1843). — Hooker, Fl. Bor.-Am. II. 150 (1839), quoad descr. sed probabiliter exclud. specim. — Carey apud Gray, Man. 429 (1848). — Britton & Brown, Ill. Fl. ed. 2, I. 602 fig. 1479 (913). — Griggs in Proc. Ohio Acad. Sci. IV. 313, t. 16 (1905) ex parte. — Robinson & Fernald, Gray, Man. ed. 7, 324, fig. 655 (1908). — Fernald in Rhodora, XI. 157 (1909). — *S. myrtilloides* Tuckerman in Am. Jour. Sci. XLV. 34 (1843), non Linnaeus. — An-

dersson in Öfv. Svensk. Vet.-Akad. Förh. XV. 125 (1858). — Gray, Man. ed. 5, 465 (1867). — Bebb apud Gray, Man. ed. 6, 485 (1889). — Britton Man. 316 (1901). — Britton & Brown, Ill. Fl. I. 505, fig. 1204 (1896). — Piper in Contrib. U.S. Nat. Herb. VI. 214 (1906). — Ball in Proc. Iowa Acad. Sci. VII. 153, t. 12, fig. 14 (1900). — *S. myrtilloides* [subspec.] *S. pedicellaris* Andersson in Svensk. Vet.-Akad. Handl. 96 (1867). — *S. myrtilloides* var. β *pedicellaris* Andersson in De Candolle, Prodr. XVI.² 230 (1868).

The history, geographical distribution and variability of this "attractive bog willow" was fully given by Fernald in 1909. I do not wish to repeat what this excellent observer has said, and only the following statements from my own observations may be added. The shape of the leaves of the European *S. myrtilloides* is not always different from that of the American species. I have repeatedly observed in American specimens (see for instance Sandberg's No. 521) round-ovate or ovate-oblong leaves which are broadest near the base and rounded or subcordate at base but as a whole the differences indicated by Fernald hold true. I do not, however, agree with his interpretation of the type. Pursh indeed says: "foliis . . . utrinque concoloribus" but his plant was collected in April, and he apparently had not seen mature leaves I have seen all the specimens referred to the type by Fernald but all of them have leaves with at least a partly more or less glaucescent undersurface. I am not convinced that the plant of Pursh of which no type specimen is in existence has to be regarded as different from the widely distributed form which Fernald has named var. *hypoglauca* (in Rhodora, XI. 161 [1909]). Pursh's plant came from the Catskill Mountains in New York, a region from which I have not seen any material of *S. pedicellaris*.

Fernald's var. *tenuescens* (l. c.162) seems to me hardly more than a form with narrower leaves. There are some specimens from Illinois (Palmer, No. 15561, in A.) and from Indiana (Deam, No. 20118ª, in A) which need further observation.

2. **S. prolixa** Andersson in Svensk. Vet.-Akad. Handl. VI. 94 (1867); in De Candolle, Prodr. XVI.² 229 (1868). — Macoun, Cat. Can. Pl. I. 452 (1886). — Ball apud Piper & Beattie, Fl. N. W. Coast, 115 (1915). — Of this "forma elegantissima habitu omnino singulari" I have seen a photograph and fragments of the type which was collected by Lyall "ad Lower Frazer-River, 49 l.b." in 1859. Unfortunately I have misplaced part of my notes and sketches on it. According to Ball (1915) it chiefly differs from *S. pedicellaris* by longer pedicels, and thinner leaves with a coarser reticulation. It is said by Macoun (1886) to be "not uncommon around Victoria, Vancouver Island, also in the Valley of Thompson River, at Spence's Bridge, B.C." I asked Professor J. K. Henry, the well-known author of the Flora of Southern British Columbia for his opinion on this species, and he wrote to me in a letter of September 7, 1919, as follows: "As to *Salix prolixa* Andersson: I have never seen an authentical or typical specimen of this

plant. The Victoria collectors cannot find it. My own feeling was that it is not distinct from the very common *S. Mackenziana* the leaves of which are sometimes green beneath when the fruit is mature. Willow leaves, on this coast at least, mature very slowly and it is often midsummer before they assume the final shape and character. It does not seem to me that the analysis of Piper & Beattie in their Flora of the North West Coast is very satisfying as far as these two species are concerned. *Salix Mackenziana* about Victoria, B.C., is often a low shrub, while the scales are not black even when dry. The stipules, too, vary. Possibly, however, the specimens I enclose from New Westminster (from a shrub . . . on the moist bank of the Frazer River) you may consider *S. prolixa*."

I am not able to give a final judgment on these specimens. The type of *S. prolixa* is not sufficient to decide the question whether it is a good species or not. It does not possess well-matured fruits and leaves. Henry may be right that the plant which is considered to be *S. prolixa* by Ball does not represent a distinct species. On the other hand, *S. prolixa* may belong to those good species which have a very limited distribution, and are still in need of a better understanding. Not being well enough acquainted with some western forms of the *Cordatae* group I leave it to Ball and other salicologists to demonstrate the true taxonomic value of Andersson's species.

3. **S. fuscescens** Andersson in Svensk. Vet.-Akad. Handl. VI. 97 (1867); in De Candolle, Prodr. XVI.^{2} 230 (1868), excl. var. — Coville in Proc. Wash. Acad. Sci. III. 329, fig. 25 (1901). — *S. myrtilloides* f. 1 et 2 Chamisso in Linnaea, VI. 539 (1831). — *S. rhamnifolia* Hooker & Arnott, Bot. Voy. Beechey, 117, t. 26 (1832), excl. citat., non Pallas. — *S. phlebophylla* Rydberg in Bull. N.Y. Bot. Gard. I. 274 (1895), ex parte, quoad pl. Cape Blossom, non Andersson. — This species has been founded upon Hooker's *S. rhamnifolia* from "Awatschka Bay, in lat. 53°," Kamtchatka, the type of which was collected by Beechey & Mertens and is still unknown to me. In 1858, Andersson mentioned *S. rhamnifolia* Hooker but then he evidently was not quite sure whether this was identical with the plant Pallas and Ledebour took for this species. He also cited Chamisso's *S. myrsinites* (in Linnaea VI. 540) "ad sinum S:cti Laurentii" of which I have not seen the type, and also Chamisso's forms 1 and 2 of *S. myrtilloides* which, too, I have had no opportunity to compare. No. 1 came "e sinu Eschscholtzii" in Alaska, while No. 2 was collected "in paludibus prope Tigil Kamtschatcae occidentalis." In 1867 Andersson proposed the name *S. fuscescens* for what Hooker has called and figured as *S. rhamnifolia.* Andersson's fig. 54 quoted by him in 1868 is not given in his monograph.

Judging by the description and figure given by Hooker and by Andersson's own diagnosis I believe that the specimens regarded by Coville and myself as *S. fuscescens* really represent this species. I have not seen it from America except from Alaska and not eastward of the 150°. The following specimens which I have seen are not mentioned by Coville.

ALASKA. Kuskokwim Valley, 1884, *Weinmann* (f., fr.; G.); between Tyonok, on Cook Inlet, and Rampart City, Yukon River, Camp 7, Beluga Valley, about 330 m., June 10, 1902, *A. H. Brooks & L. M. Prindle* (fr. im.; W.); Yukon Delta, July 14, 1889, *J. C. Russell* (fr.; W.); St. Lawrence Island, July 13, 1899, *B. E. Fernow* (f.; Cor.); Lake Iliamna Region, Iliamna Bay, in sphagnum marsh, June 22, 1902, *M. W. Gorman* (No. 41, fr.; W.; "prostrate and creeping"); Valley of Kobuk River, at Kobuk portage between Alatna and Walker Lake, July 3, 1901, *W. C. Mendenhall* (fr.; W.; "small and creeping, from 3 to 10 in. high. Common in low places"); Seward Peninsula, Nome, 1914, *G. A. Hill* (No. 84, f.; W.); tundra behind Nome, "on moss hummocks plentiful," June 17, 1903, *F. L. Hess* (f., m.; St.; "in spreading communities"); Vicinity of Port Clarence, near entrance to lagoon, below mouth of Kuzitvin River August 2, 1901, *F. A. Walpole* (No. 1674, fr.; W.); Port Clarence, July 12, 1899, *B. E. Fernow* (f.; Cor.); Norton Sound, St. Michael, July 10, 1889, *J. C. Russell* (f.; W.); Cape Blossom, 1884, ? *S. B. McLenyan & St. Corvin* (fr.; G.; Rydberg 1899 as *S. phlebophylla*).

NORTHEASTERN ASIA. Arakam (Tchetchene) Island, 1853/6, *C. Wright* (fr.; G.; mixed with an *arctica* form).

In 1907 Fernald stated that *S. fuscescens* "hitherto known only from northern and western Alaska and the adjacent coast of Siberia, is abundant in bogs on the serpentine tableland of Mt. Albert" on the Gaspé Peninsula. According to my own observations the eastern specimens all belong to var. *hebecarpa* described by Fernald, and it may even be that this variety can be raised to the rank of a species. It chiefly differs from typical *S. fuscescens* by foliis saepissime apice paullo acutiusculis vel distincte acutis, capsulis pedicello brevi ut videtur fere semper piloso vix ultra 1.5 mm. longo excluso vix ultra 6–7 mm. longis brevius rostratis basi crassioribus, saepissime plusminusve vel omnino (praesertim basi) pilosis et distinctius glaucescentibus. What Fernald regards as typical *fuscescens* is in my opinion, only a glabrescent form of var. *hebecarpa* of which the pedicels never become wholly glabrous, and are always comparatively shorter and thicker than those of true *fuscescens*.

There is a female specimen collected by Trelease & Saunders under No. 3443 mixed with *S. ovalifolia* which Coville refers to *S. fuscescens*. It has, indeed, flowers very similar to those of this species but the ovaries are hairy and borne on shorter and thicker pedicels. It looks to me like a hybrid, and I do not think that it is a hairy form of *S. fuscescens* identical with the eastern var. *hebecarpa*.

There remain to discuss several species which I at present am unable to refer to one of the sections with which I have dealt.

The first is

S. arbusculoides Andersson in Svensk. Vet.-Akad. Handl. VI. 147 t. 8. fig. 81 (1867), excl. var. *glabra*. — Bebb in Bot. Gaz. XV. 54 (1890). — Macoun, Cat. Can. Pl. II. 358 (1890). — Coville in Proc. Wash. Ac. Sci. III. 323, fig. 21 (1901). — Rydberg, Fl. Rocky Mts. 196 (1917). — *S. arbuscula* Andersson in Öfv. Svensk. Vet.-Acad. Förh. XV. 130 (1858), excl. var. *labradorica*, non Linnaeus. — *S. humillima* Andersson in De Candolle, Prodr. XVI.^{2} 248 (1868), excl. var. *glabra*. — Macoun, Cat. Can. Pl. I. 449 (1886). —

This Willow was first mentioned by Hooker (1839) as *S. acutifolia* Willdenow. Hooker gave a short description from specimens collected by Drummond and Richardson "Saskatchawan to Fort Franklin on the Mackenzie River," and said: "Mr. Borrer considers this to be the same as true *acutifolia* of Willdenow, from the Caspian Sea." This was, of course, a mistake, and our Willow has nothing whatever in common with Willdenow's well-known species. Hooker himself apparently regarded Borrer's determination as doubtful because he expressly stated that the twigs are not pruinose in the dried specimens. In the Herbarium of the New York Botanical Garden I have found a specimen of Richardson's from the Mackenzie River under "No. 65 Hb. H.B. & T.," and another specimen labeled "*Salix acutifolia* Fl. Bor. Am." of which the later indeed represents the typical *S. arbusculoides*. In 1858, Andersson mentioned *S. acutifolia* Willdenow saying nothing but "Ramum foliatum tantum in herb. vidi." He never quoted Hooker's plant. According to Bebb he passed the specimens of Drummond and Richardson in the Hookerian herbarium as *S. petiolaris*. He referred, in 1858, the plants on which he later based his *S. arbusculoides* to *S. arbuscula* Linnaeus, and at this time he proposed a *S. arbuscula labradorica*, a name later omitted by him. He did not cite a type for it, and only stated "Labrador." In describing his *S. arbusculoides* he gave as type specimen "Prince Albert's Sound (Mietscherling)," and he added "Raë River (Dr. Raë)," and "et in Labrador." (In 1858 he wrote "Miertsching" and "Roe.") Later in the Prodromus Andersson proposed a new name, and said of *arbusculoides* "nomine incaute graeco-latino delendo." Here he cited Labrador with a ?. In 1867 as well as in 1868 Andersson has two varieties: var. *puberula* and var. *glabra*.

Bebb, in 1890, has already discussed this species, and stated that "Prof. Macoun who examined Andersson's types for me in the Kew Herbarium, says, that the specimens of Mieschring and Dr. Raë are all on one sheet with no means of telling to which, respectively, the labels belong; that they comprise apparently two or more species and are very imperfect, a few bearing young catkins." I have had no opportunity to compare these specimens but have examined copious material of this species from which I am able to draw the diagnosis given below.

It has been described, too, by von Seemen (1895) as *S. saskatchawana* who based his species on Hooker's *S. acutifolia* of which I have seen the type. Von Seemen does not refer to *S. arbusculoides* or *S. humillima*, and probably did not know Bebb's note. According to a fragment of Von Seemen's type his species is nothing but Andersson's var. *glabra*, and certainly not a form of specific rank. Of the typical *S. arbusculoides* the following description may be given to enable a better understanding of this little known species.

Frutex in regione arctica humilis sed apud Dawson fide cl. Eastwood interdum arbuscula ad 3–6 m. alta ramis rubescentibus nitidis erectis vel interdum pendentibus; ramuli ab initio glaberrimi vel novelli minute puberuli et cito glabrescentes, hornotini olivacei vel ut annotini atrofusci vel casteani, nitiduli, dein atro-purpurascentes; gemmae floriferae (Eastwood

No. 16) conicae, subrostratae, apice subrecurve, ad 8 mm. longae, fuscae, nitidulae, glabrae, foliiferae ut videtur magis ovoideo-oblongae, breviores. Folia adulta chartacea, minora lineari-lanceolata, majora anguste lanceloata, rarius anguste elliptico-lanceolata, 1.5:0.4 ad 8:1.3 vel in ramulis vegetioribus ad 9:1.8 (vel in No. 467 Eastwoodiae ad 12:2.8 vel 14:2.3) cm. magna, utrinque acuta vel apice sensim breviter acuminata, subintegra, vel plus minusve dense breviter glanduloso-serrata, dentibus 1–20 pro 1 cm., superne ut videtur saepissime ab initio glaberrima vel novella pilis sparsis brevibus adpressis praedita, intense vivide viridia, nitidula, laevia, costa flavescenti nervisque lateralibus planis vel parce prominulis et laxe graciliter reticulata, in epidermide haud stomatifera vel stomatibus plusminusve numerosis (saepe tantum ad costam) praedita, subtus discoloria, glaucescentia vel fere albescentia, initio (infimis exceptis glabris) dense adpresse sericea pilis argenteis saepe cum fulvis mixtis, vel tantum parce pilosa et demum plusminusve vel omnino glabrescentia, adulta interdum parce fulvo-sericea, costa flavescenti prominula nervis lateralibus utrinque ad 14 tenuiter prominulis parallelibus angulo acuto circ. 40–45° a costa abeuntibus, vix vel tenuissime reticulata; petioli superne sulcati et (saltem initio) minute puberuli, (2–) 4–8 (–11) mm. longi; stipulae nullae vel distinctae, lineari-lanceolatae, glanduloso-serratae, vix ultra 5 mm. longae, in surculis interdum latiores brevioresque. Amenta praecocia vel subcoetanea, anguste cylindrica, subsessilia, mascula (1–) 1.5–4:1 cm. magna, elongata, saepe subcurvata vel flexuosa, basi pedunculo 1 ad vix 5 mm. longo foliolis minimis linearibus normalibus vel squamiformibus 2–3 instructo; bracteae oblongae vel subobovato-oblongae, apice obtusae vel subretusae (sed in eodem amento etiam subacutae) vel angustiores et acutiores, semper fuscescentes vel atrobrunnescentes, sparse et satis breviter vel ad apicem densius longe sericeae; stamina 2, filamentis glabris liberis vel imo basi brevissime coalitis, demum bracteam duplo superantibus, antheris parvis subglobosis vix 1 mm. longis in vivo ut videtur purpurascentibus: glandula 1, ovoideo-conica vel ovoideo-rectangularis, apice late truncata, sæpe leviter emarginata, 2–2 $\frac{1}{2}$-plo longius quam lata; amenta feminea sub anthesi pedunculo brevi excluso 1.5–3.5:0.5–0.6 cm., fructifera 2:1 ad 6:1.2 cm. magna, pedunculo circ. 3–8 mm. longo ut in masculis foliolato suffulta; bracteae ut in masculis, fere semper obtusae, forma pubescentiaque variabiles; ovaria ellipsoideo-conica, dense breviter sericeo-tomentosa; styli 0.2–0.8, rarius ad 1 mm. longi, saepissime subbifidi, stigmatibus parvis brevibus bifidis divaricatis iis aequilongis (vel initio sublongioribus); glandula ut in masculis, interdum vix longior quam lata sed saepissime 2–3-plo altior; fructus maturi tenuius quam ovaria tomentosi, e basi ellipsoideo vel ovoideo plusminusve rostrati, 5–7.5 mm. longi, pedicello 0.5–1.25 mm. longo excluso.

SPECIMENS EXAMINED: NORTHWEST TERRITORIES. Fort McPherson, July 11, 1904, *E. A. Preble* (Nos. 350, 351, fr.; W.); Fort Norman, Mackenzie, June 12, 1904, same coll. (No. 322, f.; W.); half way between Fort Rae, Great Slave Lake, and MacTavish Bay, Great Bear Lake, Lake St. Croix, August 10, 1903, same coll. (No. 247, st.; W.; forma ad var. *glabram* referenda); Great Slave Lake, Loon

Island, fifty miles north of Fort Resolution, July 10, 1901, *E. A. & A. E. Preble* (Nos. 133, 134, f.; W.); Slave River, about 45 mi. from mouth, August 29, 1914, *F. Harper* (No. 99027, st.; O.); Fort Resolution, July 14, 1901, *E. A. & A. E. Preble* (No. 151, st.; W.); June 21, 1903, *E. A. Preble* (No. 201, f.; W.); Nahami Mts., June 6, 1904, same coll. (No. 317, f.; W.); Churchill, Hudson Bay, August 2, 1910, *J. M. Macoun* (No. 79152, fr.; O.)

Yukon Territory. Vicinity of Dawson, island near footbridge, July 13, 1899, *R. S. Williams* (fr.; N.); same vicinity, April 26, 1914, *A. Eastwood* (No. 16, winter-buds; A.); June 29, 1914, same coll. (No. 31, st.; A.; ad var. *glabram* spectans); May 21, 1914, same coll. (No. 56, partim, f.; A.; ut praecedens); May 14, 1914, same coll. (Nos. 56, partim, f., 57, m.; A.); May 15, 1914, same coll. (Nos. 64,. m., 65, f.; A.); May 21, 1914, same coll. (Nos. 85, f., 87, m.; A.); May 23, 1914, same coll. (Nos. 98, m., 99, f., 100, m.; A.); May 26, 1914, same coll. (No. 106, f.; A.); June 2 and 3, 1914, same coll. (Nos. 129, m., 130, f.; A.); July 13, 1914, same coll. (No. 217, fr. submat.; A.; var. *glabra*); July 14 and 15, 1914, same coll. (Nos. 229, 239, 240, fr.; A.); June 19, 1914, same coll. (Nos. 301, st.; var. *glabra;* 302, fr.; A.); West Dawson, July 16, 1902, *J. Macoun* (No. 54402, st.; O.: "a small straight tree"); trail to Moosehide, July 1, 1914, *A. Eastwood* (No. 467, st. surc.; A.); islands in Klondike River, July 15, 1902, *J. Macoun* (No. 54401, fr.; O., partim var. *glabra*); Colorado Pup, July 29, 1902, same coll. (No. 54400, st.; O.); Ogilvie, July 8, 1914, *A. Eastwood* (No. 540, st.; A., var. *glabra*); Hard Luck Slough, July 10, 1914, same coll. (No. 565, fr.; A.); Cormacks, July 1, 1914, same coll. (No. 584, st.; A.); Carcross, Lake Bennett, July 16, 1914, same coll. (No. 725, st.; A.); Ingersoll Islands, moist sloughs and river bottoms, May 28, 1899, *M. W. Gorman* (m., f.; N.; "this willow is much eaten by Moose").

Alaska. White Pass, July 23, 1914, *A. Eastwood* (No. 860, fr.; A.; an uncertain form of which the young leaves are rather tomentose along the under side of the midrib); Fort Gibbon on Yukon River, August 1, 1905, *C. N. H. Heideman* (No. 83, st.; W.; forma incerta; surculi foliis elliptico-lanceolatis membranaceis ad 10:2.2 cm. magnis breviter acuminatis subtus glaucis tenuiter brevissime adpresse sericeis stipulis linearibus).

Alberta. Jasper Park, near Jasper, July 22, 1917, *J. M. Macoun* (No. 95376, st.; A., O.); Athabasca River, July 23, 1918, same coll. (No. 95373, fr.; A., O.), same River, near bridge, east end, mixed alluvial soil and gravel, June 20, 1918, same coll. (Nos. 95750, m., 95751, fr. submat.; 95769, f.; 95770, m ., f.; A., O.)

The localities of Drummond's specimens are uncertain. They are preserved in Herb. N. under "No. 61, Hb. H.B. & T.," fr., "marshes near Rocky Mts."; "No. 62, Hb. H.B. & T." f., and "No. 63, Hb. H. B. & T." st. No. 62 is Drummond's No. 663.

As a variety may be kept

S. arbusculoides var. **glabra** Andersson in Svensk. Vet.-Akad. Handl. vi. 148 (Monog. Salic.) (1867). — *S. acutifolia* Hooker, Fl. Bor.-Am. ii. 150 (1839), non Willdenow. — *S. humillima* var. *glabra* Andersson in De Candolle, Prodr. xvi.^{2} 248 (1868). — *S. saskatchavana* von Seemen in Bot. Jahrb. xxi. Beibl. 52, 7 (1895). — *S. saskatchewana* Rydberg, Fl. Rocky Mts. 198 (1917).— This is probably nothing but a glabrescent form and needs further observation. I refer to it the specimens mentioned as var. *glabra* in the enumeration above, and Richardson's plant from Fort Franklin preserved under "No. 65 Hb. H.B. & T." in Herb. N.

As to the true relationship of *S. arbusculoides* I do not wish to make a definite statement. Sometimes the leaves have rather numerous stomata

in their upper epidermis but not unfrequently I could not detect any trace of them. The length of the style and of the pedicel varies to a certain degree, and the shape of the gland is not always alike. These variations need further study. As to the Yukon plant at Dawson Miss Eastwood in a field note makes the following statement: " In habit it is variable but is generally tall and erect with dark red glossy stems. Some bushes have pendent branches, and some have almost fastigiate branches. It often becomes 10–20 feet high, and forms a great deal of the Willow growth along sloughs. It is common along the fence near the barracks, and in the slough on Fifth Street where the bridge crosses. It is one of the features of the vegetation in the town."

The second species of doubtful affinity is

S. argyrocarpa Andersson in Svensk. Vet.-Acad. Handl. VI. 107, t. 6, fig. 60 (Monog. Sal.) (1867); in De Candolle, Prodr. XVI.^{2} 233 (1868). — Bebb in Bull. Torr. Bot. Club, XVI. 211 (White Mt. Will. III) (1889); apud Watson & Coulter, Gray Man. ed. 6, 483 (1890). — Britton & Brown, Ill. Fl. I. 500, fig. 1190 (1896); ed. 2, I. 603 fig. 1484 (1913). — Britton, Man. 318 (1901). — Robinson & Fernald, Gray's Man. ed. 7, 327, fig. 664 (1908). — Von Seemen in Ascherson & Graebner, Syn. Mitteleur. Fl. IV. 92 (1909). — *S. repens* ? Bigelow, Fl. Bost. ed. 3, 392 (1840), non Linnaeus. — Carey apud Gray, Man. 430 (1848). — Andersson in Öfv. Svensk. Vet.-Akad. Förh. XV. 126 (1858). — *S. fusca* Oakes in Mag. Hort. Bot. Harvey, VII. 184 (Not. Rar. Pl. New Engl. 7) (1841), non Linnaeus. — *S. ambigua* Tuckerman in Am. Jour. Sci. XLV. 35 (1843), non Ehrhart. — *S. labradorica* Schw. in Herb. ex Bebb in Bull. l. c. 211 (1889), nom. nudum. — *S. argyrocarpa sericea* Andersson in Svensk. Vet.-Akad Handl. VI. 107 (Monog. Sal.) (1867); in De Candolle, Prodr. XVI.^{2} 234 (1868). — *S. depressa* Barratt in Herb., nom. nudum, non Fries.

Bebb (1889) has dealt with this Willow quite extensively. The synonymy given above furthermore shows how this species has been treated by previous authors. I am not sure whether Pursh's *S. repens* (Fl. Am. Sept. 610 [1814]) really is the same as our species. He had a Willow in mind that came from "Nova Scotia and New Foundland," and was "a very small creeping species." I have not yet seen specimens that agree with Pursh's description which apparently is partly taken from Willdenow. Pursh says that the ovaries are pubescent but the capsules glabrous. Von Seemen seems to have been the first who observed the presence of two glands in the male flowers, and he therefore placed this species with *S. glauca*. In my opinion it cannot be referred to sect. *Glaucae*, and may represent the type of a special group.

Besides var. *sericea* which is nothing but the type Andersson in 1867 described as var. "*glabrior:* foliis magis aequalibus, supra nitide, subtus opaco-viridibus denudatis" which name he (1868) changed into var. *denudata* where he says: "foliis utrinque glabris, subtus opace viridibus, iis *S. pedi-*

cellaris subsimilibus." Not citing a type specimen it is almost impossible to tell what Willow Andersson may have had before him.

I have been able to examine specimens from the White Mountains in New Hampshire, from Table-top Mountain in Gaspé Peninsula and from various localities in southern Labrador.

When I dealt with the species of section Glaucae in my 2nd and 3d notes (see Bot. Gaz. LXVII. 58 [1919]) I omitted a curious species described by Rowlee as *S. Maccalliana* of which he said that it is "obviously related to *Salix glaucops* Anders., but differs in having glabrous serrate leaves. Its leaves and buds suggest *S. lucida*." After having examined probably all the material preserved in American herbaria up to 1919 I suppose that *S. Maccalliana* indeed can be regarded as a member of this group because the flowers show a strange similarity to those of *S. glauca* var. *glabrescens*. The male flowers have a dorsal gland, and the pubescence of the straw-colored or light brown bracts is short. The leaves, however, present a wholly different aspect, and somewhat resemble those of forms which Ball names *S. pseudomyrsinites*, a species of the *Cordatae* group. I will give the following precise description and enumerate the specimens.

S. Maccalliana Rowlee in Bull. Torr. Bot. Club XXXIV. 158 (1907). — Henry, Fl. S. Brit. Col. 97 (1915). — Rydberg, Fl. Rocky Mts. 198 (1917). — Frutex 1–2 m. altus, ut videtur erectus, strictus, ramosus; ramuli novelli sparse pubescentes, cito glabri, ? balsamei, hornotini olivacei vel purpurascentes, saepe ut annotini biennesque castanei, nitiduli, vetustiores ignoti; gemmae bene evolutae nondum visae. Folia matura crasse chartacea, inferiora minora pedunculorumque anguste vel lineari-lanceolata vel oblanceolata, gradatim in superiora majora anguste elliptico-lanceolata vel anguste elliptico-oblonga abeuntia, basi acuta vel obtusa, apice subacuta vel subacuminata, 1.5 : 0.5 ad 6.5 : 1.6 vel in surculis ad 8(–9) : 2.5 cm. magna, margine incrassato distincte glanduloso-crenato-dentata dentibus circ. 2–4 pro 5 mm., superne novella pilis griseis fulvisque saepe satis difficile recognoscendis obsita, in costa saepe densius pilosa, demum subito satis vel omnino glabrescentia, intense viridia (in vivo nitidula?), costa nervisque lateralibus flavescentibus plusminusve planis et subtiliter reticulata, in epidermide stomatibus satis magnis ellipticis subnumerosis instructa, subtus initio ut superne pilosis et demum glabra, viridescentia, vix vel paullo pallidiora, ? subnitidula, costa elevata nervisque lateralibus utrinque circ. 8–14 prominulis et etiam tenuiter reticulata; petioli 2–8 mm. longi, flavobrunnei, superne sulcati et pilosuli; stipulae etiam in surculis non visae. Amenta coetanea, pedunculata, rhachi villosa, mascula ovoideo-cylindrica, pedunculo brevi (vix ultra 8 mm. longo) foliola 3–4 normalia ad 2 : 0.6 cm. magna gerente excluso 1.5–2 : 1.2 cm. magna, densiflora; bracteae anguste obovato-oblongae, apice rotundae, flavescentes, breviter pilosae, sed versus apicem plusminusve glabrescentes, venosae; stamina 2, filamentis liberis, circ. $\frac{1}{3}$ pilosis bracteam demum duplo longioribus, antheris flavis ellipsoideis

circ. 1.5 mm. longis; glandulae 2, ventralis ovoideo-conica vel saepe bipartita, bractea subtriplo brevior, dorsalis minima interdum plusminusve 3-partita; amenta feminea sub anthesi nondum visa, adultiora circ. 3.5–4: 2 cm. magna (pedunculo ad 1–2 cm. longo 3–4-foliolato excluso), basi plusminusve laxiflora, fructifera ad 5:1.6 cm. magna; bracteae ut in masculis, saepe omnino breviter pilosae; ovaria anguste ovoideo-oblonga, dense breviter argenteo-sericeo-tomentosa; styli distincti, 0.8–1.3 mm. longi, apice saepissime bifidi, stigmatibus oblongis divaricatis bifidis stylo paullo ad duplo brevioribus; pedicelli initio glandulam duplo dein ad triplo superantes, in fructu circ. 2 mm. longi; glandula 1, late ovoideo-rectangularis, saepissime bipartita. Fructus maturi e basi ovoideo-rhombica rostrati, 8–10 mm. pedicello excluso longi, ut ovaria tomentosi.

SPECIMENS EXAMINED: ALBERTA. Edge of Bow River, near Cave and Basin, about 1500 m., July 10, 1899, *W. C. McCalla* (No. 2252[a], partim, f.; N.); vicinity of Banff, on water's edge along road to Sun Dance Canyon, about 1500 m., July 10, 1890, same coll. (No. 2252[a], partim; Cor.; "about 1 m. high"); low ground along road to Devil's Head Lake, about 1500 m., June 19, August 11, 1899, same coll. (No. 2252, type, m., st.; Cor. "1.5 m. high"); Banff, August 13, 1908, *Olson* (f.; G.); Morley, foothills of Rocky Mts., damp places, June 17, 1885, *J. Macoun* (No. 24506; O.; olim No. 17, C.); Banff, Cave Avenue, July 4, 1891, same coll. (No. 24517, fr.; O.; olim nos. 28 and 33 in C.); marshy flat near the Bow River, July 15, 1891, same coll. (No. 28, fr., C.; "bush 1.2 m. high"); Spray River, June 30, 1891, same coll. (No. 33, fr.; C.; "low spreading bush on the borders of the same marsh").

BRITISH COLUMBIA. Yale District, Armstrong in the Okanagan Valley, 1912, *E. Wilson* (No. 2, f., m., fr.; Cor.; in O. sub No. 87817); Kootenay District, Cranbrook, June 22, 1914, *J. K. Henry* (fr.; Cal.; "clumps 1.2 to 1.8 m. high").

SASKATCHEWAN. Prince Albert, Camp, thickets by railway, July 6, 1876, *J. Macoun* (No. 13675, st.; Cor., O.); west of Eagle Creek, Bare Hill, in a bog, July 31, 1906, *J. Macoun & W. Herriot* (No. 70260, st., O., G.).

MANITOBA. In thickets east of Brandon, June 6, 1896, *J. Macoun* (No. 13666, fr. im.; C., Cor., O.).

ONTARIO. Thunder Bay District, Lake Superior, north shore, by C.P.R.R. in SW. between Port Arthur and Fort Williams, July 23, 1883, *W. R. Dudley* (f.; C.).

VIENNA, *May*, 1920.

THE LIGNEOUS FLORA OF THE STAKED PLAINS OF TEXAS

ERNEST J. PALMER

THE traveler who has passed over the high, wind-swept, grassy plains of the Texas Panhandle and viewed the country only from the speeding train might perhaps imagine that an article on the trees and shrubs of the region could be as brief and trite as the celebrated treatise on the Snakes of Ireland; but a closer inspection will reveal the fact that even if Nature has essayed a sinister imitation of St. Patrick's rôle upon the ligneous flora here it has been carried out but indifferently, and that although largely confined to certain limited areas woody plants are by no means rare and the total number of species is not inconsiderable. Moreover, instead of showing any tendency

to abandon the country, both in area occupied and in number of forms, there appears to be a steady if slow increase in progress at the present time.

The southern portion of the Great Plains, occupying western Texas, rises gradually or by a series of step-like plateaus from the lower Rio Grande valley, with a maximum elevation of only a few hundred feet above sea-level, to the high plains of the Panhandle, parts of which exceed four thousand feet in altitude. The first of these, if we exclude the Rio Grande Plain, which properly belongs to the Gulf Coastal Plain, is the Edwards Plateau, set off from the lowlands by the bold Balconies Escarpment; the second is the Staked Plains, lying to the northwest of the rocky plateau and rising gradually from it. The boundary between these two regions must, therefore, be somewhat arbitrarily drawn, but in general it may be regarded as following the line of contact between the limestones of the Comanchean Series and the overlying Tertiary or Quaternary deposits, principally of gravels, sands and other unconsolidated materials, that constitute the surface formations of most of the Staked Plains area. This line runs in a southwesterly direction from near the town of Big Spring, in Howard County, to the valley of the Pecos River, in Crane County, which it follows thence at an angle of about forty-five degrees northwestward into New Mexico. On the eastern side the plateau rises abruptly from the lower bordering plain by a high escarpment or line of cliffs, the crown of which is formed by a hard, thick stratum, usually of the recent, non-marine limestone or "caliche." The more resistant nature of this upper layer is responsible for the bold character of the cliffs, and it is locally known as the "cap-rock" or "rim-rock." The escarpment is also well defined on the north, where it forms a wall of the deep valley of the Canadian River, which separates the Staked Plains from the next successive, higher stage, the Panhandle High Plains. On the west it is bounded by the valley of the upper Pecos River, in New Mexico. The margins of the plateau are in places deeply incised by the canyons of streams which have their sources in the highlands. The most important of these are on the eastern side the various branches of the Colorado, Brazos and Red Rivers, and on the west those of the Pecos. It is in these canyons and along the ravines and broken ground bordering them that most of the ligneous plants are found, and many of them are confined to such protected situations or to the marginal escarpment of the plateau.

Viewed as a whole the Staked Plains is a high, mesa-like tableland, with a remarkably level surface over its interior, and nearly destitute of running streams. The rainfall is sparse, the annual average ranging from fifteen to twenty-five inches, and its elevation and exposed position in the vast plains stretching unbrokenly from the Arctic Ocean to the Gulf of Mexico, gives it a somewhat rigorous climate, marked by great extremes of temperature, both seasonable and diurnal. Dry winds of high velocity prevail during the greater part of the year, and under their influence the potential evaporation is much greater than the total average rainfall. In addition to the normal severity and wide variations of the climate its effect upon life

conditions is augmented by the frequent tornados, blizzards and long periods of drouth to which the region is subject.

The broad plains forming the summit of the plateau present for many miles an almost featureless surface. The streams, so-called, are merely wide, shallow stretches of gravel and sand, devoid of running water or even pools except for short periods after the infrequent rains. Their courses are generally comparatively straight, with very slight fall and practically without banks.

Ascending from the lower level over the steep grades or precipitous passes of the escarpment the appropriate significance of the colloquialism, "on the plains," is apparent. Far as the eye can see extend the unbroken, grassy stretches of level surface, conveying an impression of boundless space comparable only to the great sandy deserts or to the ocean. The only natural features that vary the landscape are here and there broad, shallow depressions or sinks, defined by the deeper green of their more luxurious herbage, and perhaps the far-flung glistening ribbon of one of the waterless streams in the distance. In the refracted light of the dazzling summer sun may be seen the inverted images of cattle, buildings, fences and trees along the horizon on either hand, mirrored in the phantom lakes of the mirage. Scarcely more marked or impressive in the magnificent distances than the few and slight inequalities of nature are the tangible evidences of civilization: the ranch houses and stock sheds with the ever-present windmills, many miles apart; fences and roads no less remote, and the grazing herds of cattle that have come with the plainsmen and cowboys as successors to the once numberless buffalo and the nomadic Indians, that not many years ago held undisputed sway over these broad prairies. The traveler is sometimes startled into a realization of how very recent is the period of this great cultural transition by coming upon the whitened skulls of the bison, still occasionally to be seen about salt licks or along the streams, or by turning up the flint or obsidian arrow-heads of the primitive hunters.

Underground solution of salt, magnesia and other mineral matter has resulted in the formation of the numerous shallow depressions that are in many places so conspicuous a feature of the plains topography. These are sometimes many acres in extent but seldom more than a metre or so below the general level at their greatest depth, and as the sides slope gently towards the centre they appear to be even shallower. Following the heavier rains many of these sinks become shallow lakes, but this condition generally continues for only a short time. Practically all of the water disappears in a few days or weeks at most by evaporation, very little of it sinking to any great depth into the ground. After the water is gone a rank growth of coarse grasses and rushes springs up, and as the herbage on the level plain becomes dry and brown the contrast in color is quite striking.

The flora of the open plains is essentially grassy; species of Bouteloua, Andropogon and Festuca being very abundant. Many annual and perennial species of flowering plants are found but most of them are conspicuous only for a short time after the rainy season. Low mat-like forms are common,

with wide-spreading branches close to the ground the better to resist the constant buffeting of the dry winds. Owing to the generally light rainfall and rapid evaporation the subsoil contains little moisture and this condition, together with the great depth of ground water, offers little incentive to deep-rooted plants, those having wide-spreading, shallow root systems being the prevailing types. Ligneous plants are almost entirely absent. Occasional stunted bushes of Mesquite and the low Cat's Claw (*Mimosa borealis*) or the shrubby Senecio may sometimes be found along the slight depressions of stream beds and ravines.

The Mesquite (*Prosopis glandulosa*), which is the most frequent woody species, is here strictly shrubby, seldom attaining a height of more than one or two metres. This plant, which makes a small tree under favorable conditions, with a maximum height of twelve or fifteen metres and a trunk diameter of four or five decimetres, is everywhere in this region the most hardy pioneer of advancing forestation. It has extended its range from its original home, probably south of the Rio Grande, until it now occupies all of the lowlands of the Rio Grande plain, the lower open canyons of the Edwards Plateau and those of the Staked Plains, encircling these tablelands and extending westward through the canyons and river valleys of New Mexico and Arizona and northward into western Oklahoma. Scattered specimens are found as far north as southwestern Kansas and eastward in Texas to the boundary of Louisiana. As the most abundant and widely distributed ligneous plant over hundreds of square miles it is familiar to all travelers in the Southwest, and numerous accounts of it appear in the literature, both scientific and general, dealing with that part of the country. Over a large part of western Texas it is the only species that attains the size of a tree and it is therefore of the greatest value to the ranchers and settlers in the construction of fences as well as for fuel and other purposes. The wood is of rapid growth and rather durable; the beans and foliage are eagerly eaten by stock and furnish a valuable addition to the forage at times when grass and other herbage is dried up. Although the thin foliage affords but indifferent protection from the scorching summer sun, as the only refuge, often, in a dry, hot land its shade is most grateful both to man and beast. The testimony of travelers and early settlers in western Texas agrees that Mesquite was absent or rare not may decades ago in much of the region where it is now so abundant. While evidence of this sort must always be received with caution there can be little doubt that it has advanced widely to the northward and eastward in recent years and that the forward movement is still going on with undiminished rapidity. One of the stories told of its introduction into Texas is as follows:

At an early day in the history of the territory when the Franciscan padres were establishing missions in the San Antonio country and zealously striving, under the banner of the cross, to bestow the blessings of the true faith upon the benighted natives, while Spanish adventurers from Mexico were seeking no less assiduously, by argument of the sword, to separate them from their more material possessions and to locate the fabulous

mines and rich cities of the interior, rumors of which had reached them from earlier explorers and from native traditions, the burrows, which were the pack animals of their caravans, were fed largely upon the beans of the Mesquite, and in this way the tree was first established in the country. My informant assured me that their route from the Rio Grande, up through the Spanish Pass northwest of San Antonio, towards San Saba and the interior, could formerly be traced by the growth of Mesquite along it, and that subsequently it had spread over the country in all directions from this nucleus. I cannot vouch for the authenticity of this account, but certainly the trail of the old Spaniards pointed out through the region is near the centre of distribution of the Mesquite in Texas and it does not seem impossible that it may have been, at least in part, introduced in this way. In recent years its dissemination over wide areas has been accomplished largely by the domestic animals that feed upon it. It is claimed that in the arid regions the seeds will germinate only after having passed through the stomachs of animals. Certain it is that the undigested seeds are often distributed and the plant established in this way.

Along the southern border of the Staked Plains there is a gradual transition from the flora, as from the topography, of the Edwards Plateau and a number of the more hardy woody species of the latter region persist for some distance into the plains. Some of the trees and shrubs find their northern limit about the buttes and ridges of Comanchean limestone that appear at intervals through the more recent residual deposits, but others reappear in the canyons or persist about the marginal rim of the elevated plains. Amongst those of the former class appear to be the Riverside Walnut, Western Red-bud, Live Oak, Mexican Buckeye and deciduous Coral Bean (*Prosopis affinis*); more persistent are the Shin Oak, the Red-fruited Juniper, Hackberry, Argireta (*Mahonia trifoliata*), Gum-elastic (*Bumelia texana*) and wild China (*Sapindus Drummondii*). In flats and depressions shrubby species from the Rio Grande Plain and the more arid regions to the southwest appear. Typical of these are the Creosote Bush (*Larrea tridentata*), the slender Cactus (*Opuntia leptocaulis*), *Rhus microphylla* and *Koeberlinea spinosa*.

The marginal escarpment of the plateau with its high, perpendicular cliffs, frequently overhanging ledges of cap-rock and deep indenting coves and ravines, affords protection to many plants that are unable to maintain themselves in more open situations; but as most of the ligneous species found here are also common to the canyons, some of which have worked far back into the interior, they will be mentioned in that connection.

The streams which traverse the upper plains, with their very slight fall and shallow channels, serve to carry off the surplus water after heavy rains. However, owing to the flatness of the country, the generally dry atmosphere and almost constant winds, the amount of water that reaches them is very small in proportion to the area, most of it remaining on the surface and disappearing in a short time through evaporation. Under these conditions there is little erosion through the action of the streams in this part of their

courses; but as they approach the marginal rim the grade becomes suddenly accelerated; cascades or rapids are formed as they plunge over the precipitous cap-rock or rush down the steep slopes of the escarpment. While the streams in this stage are intermittent and their work continues for only a short time after rainy periods they are at such times very active and the nature of the deposits they encounter is generally quite favorable for rapid excavation. After the hard stratum of cap-rock has been broken down, which is accomplished rapidly along the overhanging ledges, the soft under-lying strata are easily removed. When the level of ground water is reached, which in the high plains is often several hundred feet below the surface, springs begin to issue along the canyon walls and the streams become perennial.

The small streams forming the headwaters of Red River have worked out deep channels for many miles back into the interior of the plateau. The Paloduro Canyon in Randall and Armstrong Counties, the largest of these, is one of the most remarkable erosion features of the plains and of the entire Southwest. Beginning as several narrow, shallow ravines near Canyon City it rapidly deepens and widens until in some places its floor is from 800 to 1000 feet below the level of the plains and more than ten miles in width. This enormous amount of excavation has been accomplished by a small stream in comparatively recent geological times and the work of deepening and widening it is going on with undiminished force and rapidity at present. During the summer of 1918 several days were spent by me in exploring this canyon and in studying and making collections of the plants found in it and upon the surrounding plains. As the ecological conditions and flora are quite characteristic of this interesting phase of the Staked Plains the following notes on the trees and shrubs found in this canyon may be regarded as of general application.

Approaching the canyon in its deeper sections across the plains is an interesting experience. Before you lies the seemingly endless prairie, almost as level as a billiard table; in the distance, perhaps, you see a ranch house with its outbuildings and windmills; not a ripple marks the surface of the plain and there is no apparent obstacle to prevent you continuing in a direct course to the settlement. Suddenly you come upon a shallow ravine eating its way into the plain; some low Juniper or Mountain Mahogany bushes appear along an eroded slope for a few yards and then all at once you stand upon the brink of a precipice and at your feet lies a chasm some miles in width and several hundred feet deep. On the opposite side you make out the horizontal line of the plain which continues thence as if unconscious of the interruption. Far down below, the course of a tiny stream meandering through the broad valley is marked by a fringe of trees. The canyon walls are nowhere perpendicular for their entire height, as in some of the western canyons carved through harder strata, but fall away by a series of terraces, slopes and ledges, sometimes with outstanding pinnacles and masses carved into irregular and fantastic forms. There are numerous short but deep side canyons and ravines, which in many places afford the only avenues of descent into the main canyon.

Near the summit of the canyon walls there is a stratum of soft but comparatively durable limestone several feet in thickness, locally known as the "upper cap-rock." Above it there is sometimes a slope of gravel or calcareous sand a few feet in thickness; below there is another slope of only partially consolidated calcareous material, sometimes as much as fifty feet in thickness, resting upon a thick bed of sandstone of Triassic age. This latter formation, called the "lower cap-rock," varies greatly in character. In places it is from 50 to 120 feet in thickness and ranges from a sandy shale to a coarse grained sandstone or conglomerate. Below it are the "red beds" of the Permian, consisting of soft, friable sandstones, clay and gypsum. The brick-red color of these deposits, due to the iron oxide which they contain, is imparted to the waters of the stream and gives name and character to the Red River. These soft Permian strata yield readily to erosion and every rain carries away great quantities of material broken down by each rill and temporary torrent. Sections of the cap-rock are constantly being undermined through removal of the softer underlying deposits and huge masses of it frequently piled up at the base of the cliff or in the narrow side canyons. Balancing and "toadstool" rocks are frequent where detached masses of the sandstone surmount columns of the softer material. In such places the scenery of the canyon has quite the aspect of the "bad lands" of the Northwest, and amongst the innumerable hillocks and defiles of the more rugged parts it is hard to realize that one is in the midst of the plains and not in a mountainous country.

Below the level of the plains four principal zones of plant life may be recognized in the canyon. These are the calcareous beds above and below the upper cap-rock, including that stratum, the sandstone section of the lower cap-rock and the broken belt of the Permian deposits below it, the open, comparatively level floor of the main canyon, and the immediate borders of the river and perennial, spring-fed streams. For convenience these may be designated the Upper Cap-rock, Lower Cap-rock and Talus, Canyon-floor and River-bank zones.

The following woody plants were collected in Paloduro Canyon at several points in Randall and Armstrong Counties, Texas, but principally at the J. B. Gamble ranch south of Claude in the latter County, and the brief notes are based on observations made during a rather hasty visit:

Juniperus monosperma (Engelm.) Sarg.

This species, locally called White Cedar, is one of the most conspicuous if not the most abundant of the woody plants. It occurs from the Upper Cap-rock zone, where it is usually low and shrubby, through the Lower Cap-rock-talus zone into the deep protected side canyons. In the last named situations and below high protecting bluffs it sometimes becomes a tree 20 metres or more high and with a trunk diameter of 5 or 6 decimetres.

Juniperus Pinchotii Sudw.

The species was originally described from this locality and I am applying the name to the tree or shrub called Red Cedar in the canyons, with erect rigid branches and large copper-colored fruit. It is commonly not more

than a tall shrub, often sending up a number of stems from burned-off stumps. In more protected situations it becomes arborescent, the largest specimens observed being about 12 or 15 metres in height and 4 or 5 decimetres in trunk diameter. It is rather abundant in the same zones as the last species.

Ephedra Torreyana Wats.

This interesting shrub is usually found near the summit of the canyon walls in the Upper Cap-rock zone. Its naked, Equisetum-like stems are much branched and present a very curious appearance. It was also found near Channing, in Hartley County.

Populus texana Sarg.

One of the commonest and largest tree along the margins of the river, in the deep side canyons and under the protection of cliffs is the Cottonwood, which has recently been described by Professor Sargent under this name. While not attaining the large size of some of the other Cottonwoods, specimens 20 metres high and 75 or 80 centimetres in trunk diameter are frequent. The trunks are often bent and branched from near the ground. This species was observed in Nolan, Garza, Randall, Armstrong and Hemphill Counties, and doubtless occurs elsewhere in canyons of the Staked Plains and along the northern border of the Edwards Plateau and probably extends into southwestern Oklahoma.

Salix amygdaloides Anders.

A common Willow in the River-bank zone, both in the canyons and in more open situations wherever there are running streams or pools. A tree sometimes 10 or 12 metres high.

Salix exigua var. *stenophylla* (Rydb.) Schneid.

A shrub or slender tree found rarely in the River-bank zone and watered side canyons. Much more abundant along pool and stream margins in more open situations on the plains.

Quercus Mohriana Rydb.

Very abundant along the Upper and Lower Cap-rock-talus zones. Usually a shrub from one to three metres high, but in the protection of cliffs and in deep side canyons sometimes becomes a tree seven or eight metres high, with thick, rough, pale bark and a low conical crown. The leaves are quite variable in size and shape.

Celtis laevigata var. *texana* Sarg.

A small tree common in the Canyon-floor and River-bank zones, and less abundant in the higher zones of the canyon walls.

Mahonia trifoliata Moric.

This curious and rather pretty shrub of the arid Southwest, called Argireta by the Mexicans, is occasionally found in the Lower Cap-rock-talus zone.

Morus microphylla Buckl.

The Mexican Mulberry, a typical tree of the Edwards Plateau, appears to be rather rare except along the southern border in the Staked Plains. In the canyon a few specimens were seen in the Lower Cap-rock-talus zone.